

## GROWTH PERFORMANCE OF MAJOR FLOWER CROPS IN GUJARAT STATE

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### ABSTRACT

*The study examines growth performance of major flower crops in Gujarat state for different districts. The study reveals that growth performance of major flower crops in region- wise was found to be highest in area (17.89%/annum), production (27.89%/annum) and yield (8.48%/annum) and was observed in South Gujarat region during the same period as compare to other three regions of the state. The region-wise instability showed that the area was more stable in Middle Gujarat, while the production and yield of flower crops remained more stable in North Gujarat region. The district-wise result showed that the highest rate of increase in area and production of flower crops was seen in Surendra nagar district and increase in yield in case of Amreli district. The area under flower crops remained more stable in Porbandar while production and yield was found more stable in Gandhi nagar district.*

**KEYWORDS:** Compound Growth Rate, Instability Index, & Regional Disparity

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### INTRODUCTION

Years ago Horticulture has emerged as one of the potential agricultural enterprises in accelerating the growth of economy. The role of horticulture in the country's nutritional security, poverty alleviation and employment generation programmes are becoming increasingly important. Horticulture offers not only a wide range of options to the farmers for crop diversification, but also provides ample scope for sustaining large number of Agro-industries, which generate huge employment opportunities. There is significant production increases in horticultural crops across the country, a Golden Revolution is in the offing and India has emerged as a leading player in the global scenario. India has now emerged as the world's largest producer of coconut and tea, and India is the second largest producer and exporter of tea, coffee, cashew and spices. The exports of fresh and processed fruits, vegetables, cut flowers, dried flowers have also been picking up. As a result of a number of thoughtful research, technological and policy initiatives and inputs, horticulture in India, today, has become a sustainable and viable venture for both small and marginal farmers.

The international trade in horticulture is stimulated by raising incomes and growing consumers' interest in a variety of fresh fruits and vegetables year-round. India has several advantages in this sector. India is regarded as one of the world's biggest producers of horticultural products. The production costs are less than half of those in other parts of the world. Despite these advantages, India's share in the global market is found to be insignificant and accounts for only 1.7 per cent of the global trade in vegetables and 0.5 per cent in fruits. India is the second largest producer of fruits and vegetables contributing 10 per cent and 14 per cent, respectively in the world fruit and vegetable production.

Horticulture crops have the advantage of providing higher productivity per unit of land compared to other crops in Gujarat as well as resulting in higher income and higher rural employment generation. The horticulture

sector is more labour intensive providing more employment and because of the value addition potential, it gives higher income. Fruits and vegetable cultivation can account more and provide sustained income and work to small and marginal farmers. Horticultural crops include major four groups viz. Fruits, Vegetables, Spices and Flowers with its shares in 2012-13 to the tune of 26, 36, 37 and 1 percent of the total horticulture area, respectively in the state. The total estimated area under horticultural crops has been increased from 5.89 lakh ha. During the year 1998-99 to 15.03 lakh ha. During the year 2012-13. Similarly, the estimated production of horticultural crops has been increased from 59.49 lakh tonnes during 1998-99 to 204.55 lakh tones with an average productivity of 13.61 tonnes per ha. During the year 2012-13. Gujarat is occupying 4<sup>th</sup>, 6<sup>th</sup> and 3<sup>rd</sup> places in India in production of fruit, vegetable and spices, respectively. The horticulture area is 16.5 per cent of the total agricultural area while the value of production of horticulture crop is Rs.11000 crores with its share of 23 per cent as against Rs. 48000 crores of total agriculture production.

The area under fruits, vegetables, & flowers has been estimated to 3.98 lakh ha. 5.38 lakh ha, and 0.17 lakh ha in the state for the year 2012-13, showing an increase of 4.21, 3.87, and 8.27 per cent over the previous year 2011-12, respectively, whereas area under Spices crops have decreased marginally from 5.71lakh ha. In the year 2011-12 to 5.49 lakh ha. In the year 2012-13. The production of fruits, vegetables, spices & flowers has been estimated to 85.31 lakh tonnes, 105.21 lakh tonnes, 12.54 lakh tonnes, & 1.49 lakh tonnes, in the state for the year 2012-13, showing an increase of 9.89, 4.69, 7.27 & 9.56 per cent over the previous year 2011-12, respectively. The Productivity worked out to be 21.41, 19.57, 2.28 & 8.64 tonnes per hectare, for fruits, vegetables, spices & flowers in the state for the year 2012-13, respectively.

Gujarat accounts to a wide variety of soils, rainfall pattern, temperature regimes, and availability of irrigation. This diverse agro-climatic situation across the state holds promise for development of the horticulture sector in a big way. Gujarat has tropical climate, with temperature ranging from a minimum of 13° C to 27° C in January and a maximum of 45° C in May-June. However, there is a wide annual variation in rainfall, affecting the productivity of the crops. The investment in fruit and vegetable processing units increased in the state which shows shining future of horticulture in the Gujarat State. Considering the importance of the horticulture sector in the Gujarat state, the present study was undertaken with the following specific objectives.

## OBJECTIVES

- To work out the district wise compound growth rates of area, production and productivity of major horticultural crops of the state.
- To estimate the district wise instability indices of area, production and productivity of major horticultural crops of the state.
- To study the regional disparity in growth performance of the major horticultural crops of the state.

## METHODOLOGY

To achieve the objectives of study, district wise time series data on area, production and yield of major horticultural crops of the state were collected and compiled from the Directorate of Horticulture, Gujarat State, Gandhinagar for the period from 1994-95 to 2012-13. The district wise and region wise compound growth rates (CGRs) of area, production and productivity of major horticultural crops were computed. The compound growth rates were calculated by fitting the exponential function given below:

$$Y = a b^t \quad (1)$$

Where, Y= area/ production/ productivity

a = Constant

b = Regression Co-efficient

t = Time variable

Thus, natural log on both the sides of eq.(1) was taken to convert it into linear form.

$$\text{Log } Y = \text{log } a + t \text{ log } b \quad (2)$$

The annual Compound Growth Rates (CGRs) were finally worked out using the following formula:

$$\text{CGR (\%)} = (\text{Anti log of log } b - 1) \times 100$$

The co-efficient of variation (CV) often contains the trend component and thus over estimates the level of instability in time series data which is characterized by long-term trends. To overcome this problem, the Cuddy Della Valle index was used which corrects the CV by the following formula.

$$\text{Instability Index (I I)} = \text{CV} * \sqrt{(1 - R^2)}$$

Where, CV = Co-efficient of variation and

$R^2$  = Co-efficient of determination from a time trend regression

Adjusted by the number of degrees of freedom.

## RESULTS AND DISCUSSIONS

The results of district-wise and region-wise compound growth rates as well as instability indices of area, production and yield of total flowers and individual flower crops namely; rose, marigold, mogra and lily and spices namely; cumin, isabgul, coriander, chilli and garlic are presented and discussed in this paper.

### Flower Crops

Flower crops remained more stable (3.77) as compare to production and yield in Gujarat. The region-wise results showed the highest rate of increase in area (17.89% / annum), production (27.89%/annum) and yield (8.48%/ annum) was observed in South Gujarat region during the same period as compare to other three regions of the state. The region-wise instability showed that the area remained more stable in Middle Gujarat, while the production as well as Yield of flower crops remained more stable in North Gujarat region. The district-wise result showed that the highest rate of increase in area and production of flower crops was observed in Surendra nagar district, while that of was observed in yield in case of Amreli district. The area under flower crops remained more stable in Porbandar while production and yield was found more stable in Gandhi nagar district.

**Table 1: Compound Growth Rates and Instability Index for Area, Production and Yield of Flowers (2002-03 to 2012-13)**

Sr. No.	District / Region	Compound Growth Rates (%P.A.)			Instability Index (I.I.)		
		Area	Production	Yield	Area	Production	Yield
1	Ahmedabad	09.92	08.47	-1.32 #	04.50	08.37	07.30
2	Amreli	-0.29#	19.28 *	19.63	35.03	45.11	25.21
3	Banaskantha	24.34	35.53	09.00	28.80	30.42	19.10
4	Bharuch	23.27	28.83	04.51	15.33	18.91	08.27
5	Narmada	27.30 *	32.58	04.15	35.35	37.81	07.23
6	Bhavnagar	12.79	13.41	00.56#	20.50	24.64	10.04
7	Dang	32.85	41.87	06.79	27.73	25.82	09.97
8	Gandhinagar	06.58	7.40	00.77 *	06.38	06.35	02.60
9	Jamnagar	12.59	14.64	01.82#	07.20	14.49	12.49
10	Junagadh	11.12*	15.16	03.64	40.37	40.68	06.90
11	Porbandar	13.66	28.25	12.84	23.56	29.57	19.18
12	Kutchh	07.33	12.36	04.69	02.87	08.66	07.75
13	Kheda	12.60	15.23	02.33#	10.13	15.16	20.73
14	Anand	16.65	19.30	02.28#	06.18	17.17	19.02
15	Mehsana	05.33	03.18#	-2.04#	14.76	33.58	27.25
16	Patan	06.19#	16.98#	10.16	73.94	60.45	15.47
17	Panchmahal	29.55	38.08	06.59	08.33	16.85	16.29
18	Dahod	11.89	12.15	00.24#	24.03	28.79	22.16
19	Rajkot	45.03	42.46	-1.77#	16.91	22.48	27.38
20	Sabarkantha	03.68#	14.81#	10.73	50.93	57.01	14.12
21	Surat	02.46#	09.47	06.84	20.08	26.86	08.95
22	Surendranagar	56.19	54.35	-1.82#	21.85	29.03	11.16
23	Vadodara	07.95	09.28	01.23#	14.16	16.80	09.64
24	Valsad	24.03	36.73	10.24	29.37	37.38	19.40
25	Navsari	22.58	44.25	17.68*	19.18	35.87	44.48
26	Tapi	15.85	20.82	04.29*	05.77	09.82	05.46
27	Gujarat	13.61	18.64	04.43	03.77	09.71	08.70
28	Saurashtra	15.59	20.39	04.15	12.03	13.11	06.43
29	North Gujarat	07.71	10.60	02.68	06.07	04.44	04.30
30	South Gujarat	17.89	27.89	08.48	05.97	16.75	15.73
31	Middle Gujarat	11.75	12.84	00.98#	05.42	09.52	10.64

(Note: \* indicates significant at 5% level and # indicates non significant. All remaining CGRs are significant at 1% level.)

The result of compound growth rates of individual flower crops like rose, marigold, mogra and lily are given in Table 2 to Table 5. The area, production and yield of rose flower in Gujarat were significantly increased at the rate of 10.56, 14.37 and 3.45 per cent per annum, respectively during 2002-03 to 2012-13. The area under rose flower was found to remain more stable as compare to production and yield. As far as Saurashtra region is concerned the highest and significant rate of increase in area (13.55% / annum), production (20.99% / annum) and yield (6.55% / annum) of rose flower was observed as compare to other regions of the state. The south Gujarat region remained more stable in area, production and yield of rose. As far as the district-wise CGRs are concern, the highest rate of increase in area (41.81% /annum), production (42.92% /annum) and yield (23.26%/annum) was found, respectively in the districts of Surendranagar, Narmada and Amreli. The highest stability of area, production and yield of rose flower was found in the districts of Ahemdabad, Anand and Tapi, respectively.

**Table 2: Compound Growth Rates and Instability Index for Area, Production and Yield of Rose (2002-03 to 2012-13)**

Sr. No.	District / Region	Compound Growth Rates (%P.A.)			Instability Index (I.I.)		
		Area	Production	Yield	Area	Production	Yield
1	Ahmedabad	10.00	09.19	-0.74#	03.34	11.88	13.68
2	Amreli	06.08#	30.75	23.26	27.98	34.94	32.37
3	Banaskantha	24.53	33.19	06.96#	18.51	23.39	36.50
4	Bharuch	25.36	30.86	04.39	15.85	14.89	04.43
5	Narmada	29.35	42.92	10.50	29.25	34.80	20.17
6	Bhavnagar	09.13	15.20	05.57*	09.86	23.61	20.88
7	Dang	20.56	35.54	12.43	34.86	33.27	12.88
8	Gandhinagar	-2.73#	-2.42#	00.32#	33.42	30.77	04.57
9	Jamnagar	12.52	16.71	03.73	14.31	17.50	08.97
10	Junagadh	15.02*	27.04	10.45	46.10	46.07	16.67
11	Porbandar	13.08	35.36	19.71*	22.27	30.71	28.12
12	Kutchh	16.34	27.87	09.91	17.07	23.96	15.52
13	Kheda	15.57	29.16	11.76#	33.15	23.65	25.92
14	Anand	07.38	07.71	00.31#	09.17	08.46	04.99
15	Mehsana	03.94#	00.07#	-3.72#	23.00	60.86	34.98
16	Patan	28.14	39.25	08.66	47.26	41.75	15.44
17	Panchmahal	33.31	33.55	00.18#	18.58	22.65	20.30
18	Dahod	20.01*	16.85#	-2.64#	46.31	67.89	25.86
19	Rajkot	36.42	29.61	-4.99#	15.62	26.91	32.25
20	Sabarkantha	05.15#	24.51#	18.41	84.19	97.54	24.78
21	Surat	-0.75#	3.98#	04.77	33.79	38.94	07.90
22	Surendranagar	41.81	36.53	-3.73#	13.14	17.21	19.06
23	Vadodara	07.72	11.52	03.54#	16.57	24.08	18.51
24	Valsad	07.11*	10.61	03.26#	22.32	25.61	20.98
25	Navsari	-5.61#	-0.45#	05.47	43.77	33.72	10.95
26	Tapi	02.74#	05.23#	02.42	11.35	13.15	02.63
27	Gujarat	10.56	14.37	03.45	05.40	09.52	07.99
28	Saurashtra	13.55	20.99	06.55	12.51	16.56	17.63
29	North Gujarat	06.45#	09.11*	02.50*	27.92	32.03	10.36
30	South Gujarat	10.72	15.50	04.32	08.14	09.71	06.56
31	Middle Gujarat	10.15	12.82	02.42*	08.94	12.92	11.30

(Note: \* indicates significant at 5% level and # indicates non significant. All remaining CGRs are significant at 1% level.)

The significant increase in area at the rate of 16.74 per cent per annum and production at the rate of 18.28 per cent per annum was observed in case of marigold in Gujarat during 2002-03 to 2012-13 (table 3). The area, production and yield of marigold found comparatively stable with, respectively lower indices of 3.59, 2.65 and 3.14 in Gujarat. The highest rate of increase in area, production and yield of marigold was found in South Gujarat, while highest stability of the same was found in North Gujarat as compare to other three in area (17.89% annum), production (27.89%/annum) and yield (8.48%/annum) was observed in South Gujarat region during the same period as compare to other three regions of the state. The region-wise instability showed that the area remained more stable in Middle Gujarat while the production as well as yield of flower crops remained more stable in North Gujarat region. The district-wise result showed that the highest rate of increase in area and regions of the state. The district of Surendranagar topped the list in the rate of increase in area (67.12%/annum) and production (69.86 %/annum) of marigold among the districts of Gujarat. The area under marigold was found more stable in Jamnagar while production and yield of marigold was more stable in Gandhinagar district.

**Table 3: Compound Growth Rates and Instability Index for Area, Production and Yield of Marigold (2002-03 to 2012-13)**

Sr. No.	District / Region	Compound Growth Rates (%P.A.)			Instability Index (I.I.)		
		Area	Production	Yield	Area	Production	Yield
1	Ahmedabad	08.86	04.41	-4.09	08.36	11.25	08.81
2	Amreli	10.12#	20.77#	09.67*	73.48	76.90	53.47
3	Banaskantha	28.06	41.64	10.60	36.82	42.58	34.36
4	Bharuch	21.22	22.99	01.46	09.65	11.68	04.03
5	Narmada	26.20*	27.71*	01.19#	44.26	47.89	12.45
6	Bhavnagar	17.91	13.03*	-4.14#	28.25	33.32	29.76
7	Dang	44.35	43.67	-0.85#	29.68	22.66	21.71
8	Gandhinagar	08.71	08.64	-0.06#	09.09	09.29	02.17
9	Jamnagar	14.44	19.98	04.84	09.06	13.52	10.69
10	Junagadh	15.44*	13.15*	-1.99#	45.45	49.13	10.71
11	Porbandar	13.40	22.00	07.59*	36.62	49.33	21.88
12	Kutchh	-0.06#	03.01#	03.07	25.82	25.05	07.53
13	Kheda	12.27	17.17	04.36*	29.28	37.30	17.17
14	Anand	42.37	41.04	-0.94#	14.44	17.23	07.05
15	Mehsana	04.76	03.37#	-1.32#	14.60	22.00	17.98
16	Patan	10.84*	12.98#	01.93#	34.99	53.42	28.85
17	Panchmahal	32.91	44.00	08.35	14.76	18.50	18.04
18	Dahod	15.85*	14.72#	-0.98#	67.61	70.87	15.41
19	Rajkot	48.47	45.41	-2.06#	24.12	27.59	20.00
20	Sabarkantha	10.95*	16.10*	04.64#	33.99	43.51	18.28
21	Surat	07.18*	08.86*	01.57	35.26	34.35	03.86
22	Surendranagar	67.12	69.86	01.64#	35.74	39.91	04.79
23	Vadodara	11.91	11.61	-0.27#	14.95	13.82	07.27
24	Valsad	33.50	42.28	06.57	23.46	21.98	06.79
25	Navsari	33.38	37.15	02.83*	24.93	25.80	08.25
26	Tapi	37.85	40.88	02.20*	12.94	13.75	02.95
27	Gujarat	16.74	18.28	01.31	03.59	02.65	03.14
28	Saurashtra	21.04	23.52	02.05*	13.19	16.58	10.14
29	North Gujarat	11.17	12.40	01.11	07.75	07.40	02.12
30	South Gujarat	23.74	25.39	01.33	10.65	11.39	03.54
31	Middle Gujarat	14.62	15.25	00.54#	09.29	09.24	06.73

(Note: \* indicates significant at 5% level and # indicates non significant. All remaining CGRs are significant at 1% level.)

The results of CGRs of mogra revealed that the area and production of the crop increased significantly, while the yield was decreased in the state (table 4). The highest significant increase in area of mogra at the rate of 10.82 per cent per annum was found in North Gujarat region while that of in case of production and yield was found higher in South Gujarat. The growth of area and production was non significant and in case of yield it was negative and significant (-6.77%/annum) in the Saurashtra region because of very high fluctuation in area. The region of North Gujarat registered highest rate of increase in area (10.82%/annum), while the rate of increase in production and yield was the highest in South Gujarat among four regions of the state. The area and production of mogra found more stable in Middle Gujarat region. The acreage under mogra cultivation along with its production increased at the highest rate in Banaskantha district. The lowest instability indices of area, production and yield implies the stability of mogra cultivation in Ahmedabad district.

The acreage under lily cultivation increased in Gujarat at the rate of 20.33 per cent per annum along with 39.80 and 16.18 per cent per annum increase, respectively in production and yield during 2002-03 to 2012-13 (table 5).

**Table 5: Compound Growth Rates and Instability Index for Area, Production and Yield of Mogra (2002-03 to 2012-13)**

Sr. No.	District / Region	Compound Growth Rates (%P.A.)			Instability Index (I.I.)		
		Area	Production	Yield	Area	Production	Yield
1	Ahmedabad	08.97	08.62	-0.32#	04.41	05.43	06.52
2	Banaskantha	27.78	36.87	07.11#	12.27	16.46	14.76
3	Bharuch	18.55	21.01	02.08	23.06	23.50	1.86
4	Narmada	-15.42	-14.77	00.77#	26.48	25.35	10.78
5	Bhavnagar	-20.36#	-24.15#	-4.76	28.90	30.46	07.10
6	Gandhinagar	-00.66#	-1.56#	-0.91#	30.91	28.64	06.25
7	Kutchh	12.81	15.32	02.22	12.00	13.99	03.11
8	Kheda	-17.69	-16.99	00.85#	60.94	57.93	12.82
9	Anand	00.55	00.54	-0.01	12.84	14.22	05.51
10	Dahod	-5.38#	-7.07#	-1.78#	30.53	35.92	11.49
11	Vadodara	02.52#	-5.95#	-8.26	13.94	34.08	25.10
12	Gujarat	06.71	04.68*	-1.90 #	09.52	17.86	12.22
13	Saurashtra	10.50#	-8.03#	-6.77	52.84	59.61	47.51
14	North Gujarat	10.82	10.25	-0.52#	24.93	29.99	08.99
15	South Gujarat	08.70*	11.60	02.67	36.68	37.42	02.17
16	Middle Gujarat	04.33	00.00#	-4.15	09.69	18.21	14.00

(Note: \* indicates significant at 5% level and # indicates non significant. All remaining CGRs are significant at 1% level.)

So far as the region-wise growth is concerned, The Saurashtra region topped the list in area (25.10%/annum) while the South Gujarat topped the list in production (49.10% /annum) and yield of lily (table 5). The area, production and yield of lily remained more stable, respectively in Middle Gujarat, South Gujarat and North Gujarat. The districts of Gandhinagar, Rajkot and Valsad registered highest rate of increase, respectively in area, production and productivity of lily. The stability of area, production and yield of lily was highest, respectively in Ahemdabad, Kutch and Tapi districts.

**Table 5: Compound Growth Rates and Instability Index for Area Production and Yield of Lilly (2002-03 to 2012-13)**

Sr. No.	District / Region	Compound Growth Rates (%P.A.)			Instability Index (I.I.)		
		Area	Production	Yield	Area	Production	Yield
1	Ahmedabad	14.01	34.20	17.71	08.55	23.59	25.45
2	Amreli	-12.31*	08.07#	22.34	39.63	32.13	22.59
3	Banaskantha	07.22	25.09	16.66*	25.92	40.42	42.33
4	Narmada	07.74*	18.73*	10.21#	18.95	33.83	41.36
5	Gandhinagar	70.16*	29.53	20.88	27.79	34.50	30.12
6	Jamnagar	-1.06#	-1.69#	-0.64#	57.20	52.40	72.17
7	Kutchh	02.54#	24.31	21.23	14.39	19.68	24.45
8	Kheda	25.17	23.30*	-1.50#	39.90	92.08	91.57
9	Anand	17.91	18.29*	00.33#	12.39	72.15	90.95
10	Panchmahal	37.34	62.74	18.50*	33.36	29.14	26.89
11	Dahod	-15.43#	-15.76#	-0.84#	73.57	89.38	77.59
12	Rajkot	60.66	85.98	15.76*	29.21	34.80	32.45
13	Surat	-1.46#	00.69#	02.18#	35.35	43.03	67.62
14	Vadodara	12.41	13.08#	00.60#	21.92	90.27	87.72
15	Valsad	31.69	62.88	23.68	75.88	60.42	29.81
16	Navsari	25.51	53.78	22.52	26.65	30.81	25.50
17	Tapi	-10.24#	-12.02#	-1.99#	23.79	20.59	03.87
18	Gujarat	20.33	39.80	16.18	09.88	25.79	29.16
19	Saurashtra	25.10	41.34	12.99	40.83	39.90	31.09
20	North Gujarat	05.15	26.33#	20.14	25.73	34.22	27.51
21	South Gujarat	22.96	49.10	21.26	17.00	23.26	27.79
22	Middle Gujarat	17.50	21.09	03.06#	15.67	61.10	77.76

(Note: \* indicates significant at 5% level and # indicates non significant. All remaining CGRs are significant at 1% level.

## CONCLUSIONS

The highest increase in area, production and yield of flowers at the rate of 13.61, 18.64 and 4.43 per cent per annum was observed in Gujarat during 2002-2003 to 2012-13. The cultivation of flower crops also increased in the Saurashtra region during the last decade and it remained at the second position among the four region of the state with the 15.59, 20.39 and 4.15 per cent per annum increase in area, production and yield of flower crops, respectively. The region of South Gujarat remained at the top among four regions of the state in the rate of increase in area and production of flowers. The rate of increase in yield was the highest in South Gujarat in case of flowers. The area of flowers remained more stable as compared to production and yield. The stagnation of productivity of crops like mogra in Gujarat needs appropriate technological options.